Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters

Nominal Frequencies

Frequency	Return Loss	Impedance
3300 MHz	17.4 dB	65.0 Ω + 3.5 jΩ
3400 MHz	22.8 dB	57.4 Ω - 2.5 jΩ
3500 MHz	23.0 dB	56.9 Ω - 3.2 jΩ
3600 MHz	22.7 dB	51.4 Ω - 7.3 jΩ
3950 MHz	16.5 dB	57.6 Ω + 14.4 jΩ

Additional Frequencies

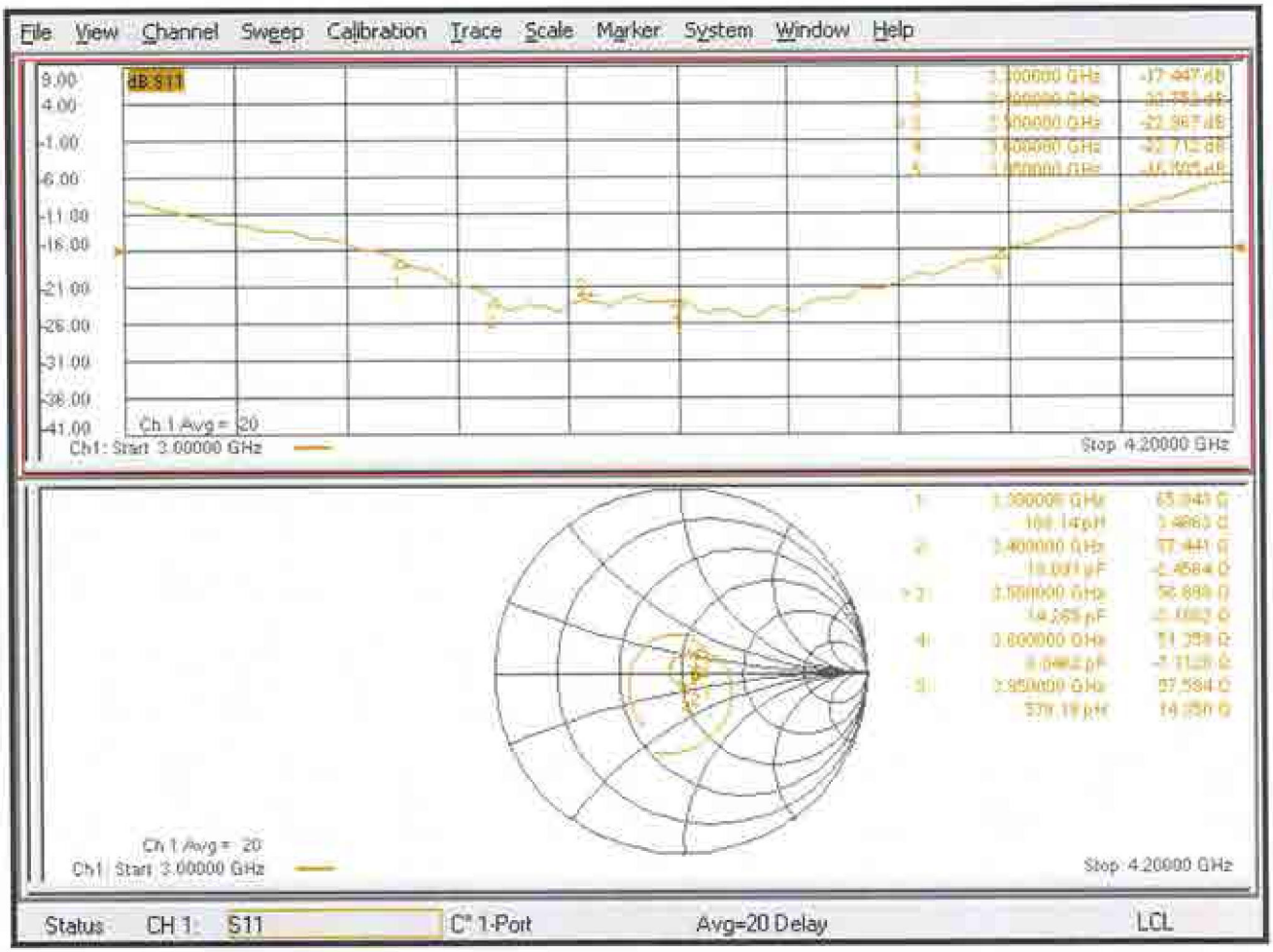
Frequency	Return Loss	Impedance
3900 MHz	18.4 dB	52.3 Ω + 1.2 jΩ

3.2 Antenna Design and Handling

The calibration dipole has a symmetric geometry with a built-in two stub matching network, which leads to the enhanced bandwidth.
The dipole is built of standard semirigid coaxial cable. The internal matching line is open ended. The antenna is therefore open for DC signals.
Do not apply force to dipole arms, as they are liable to bend. The soldered connections near the feedpoint may be damaged. After excessive mechanical stress or overheating, check the impedance characteristics to ensure that the internal matching network is not affected.

After long term use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

Impedance Measurement Plot



DASY5 E-field Result

Date: 08.06.2023

Test Laboratory: SPEAG Lab2

DUT: HAC Dipole 3500 MHz; Type: CD3500V3; Serial: CD3500V3 - SN: 1022

Communication System: UID 0 - CW ; Frequency: 3500 MHz, Frequency: 3900 MHz
Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 0$ kg/m^3
Phantom section: RF Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EF3DV3 - SN4013; ConvF(1, 1, 1) @ 3500 MHz, ConvF(1, 1, 1) @ 3900 MHz; Calibrated: 30.12.2022
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn781; Calibrated: 03.01.2023
- Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA; Serial: 1070
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole E-Field measurement @ 3500MHz/E-Scan - 3500MHz d=15mm/Hearing Aid Compatibility Test (41x121x1):
Interpolated grid: dx=0.5000 mm, dy=0.5000 mm
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 35.04 V/m; Power Drift = 0.02 dB
Applied MIF = 0.00 dB
RF audio interference level = 38.37 dBV/m
Emission category: M2

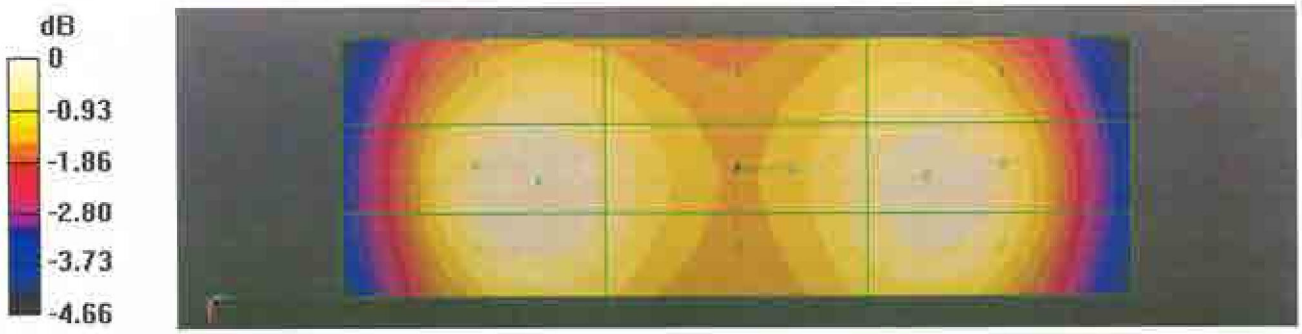
MIF scaled E-field

Grid 1 **M2** **38.34 dBV/m**	Grid 2 **M2** **38.37 dBV/m**	Grid 3 **M2** **38.06 dBV/m**
Grid 4 **M2** **38 dBV/m**	Grid 5 **M2** **38.03 dBV/m**	Grid 6 **M2** **37.79 dBV/m**
Grid 7 **M2** **38.28 dBV/m**	Grid 8 **M2** **38.31 dBV/m**	Grid 9 **M2** **38.03 dBV/m**

Dipole E-Field measurement @ 3500MHz/E-Scan 3900MHz, d=15mm/Hearing Aid Compatibility Test (41x121x1):
Interpolated grid: dx=0.5000 mm, dy=0.5000 mm
Device Reference Point: 0, 0, -6.3 mm
Reference Value = 33.23 V/m; Power Drift = -0.00 dB
Applied MIF = 0.00 dB
RF audio interference level = 38.14 dBV/m
Emission category: M2

MIF scaled E-field

Grid 1 **M2** **38.11 dBV/m**	Grid 2 **M2** **38.16 dBV/m**	Grid 3 **M2** **37.94 dBV/m**
Grid 4 **M2** **37.91 dBV/m**	Grid 5 **M2** **37.95 dBV/m**	Grid 6 **M2** **37.81 dBV/m**
Grid 7 **M2** **38.09 dBV/m**	Grid 8 **M2** **38.14 dBV/m**	Grid 9 **M2** **37.91 dBV/m**



0 dB = 82.88 V/m = 38.37 dBV/m

CD3500V3, serial no. 1022 Extended Dipole Calibrations

If dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

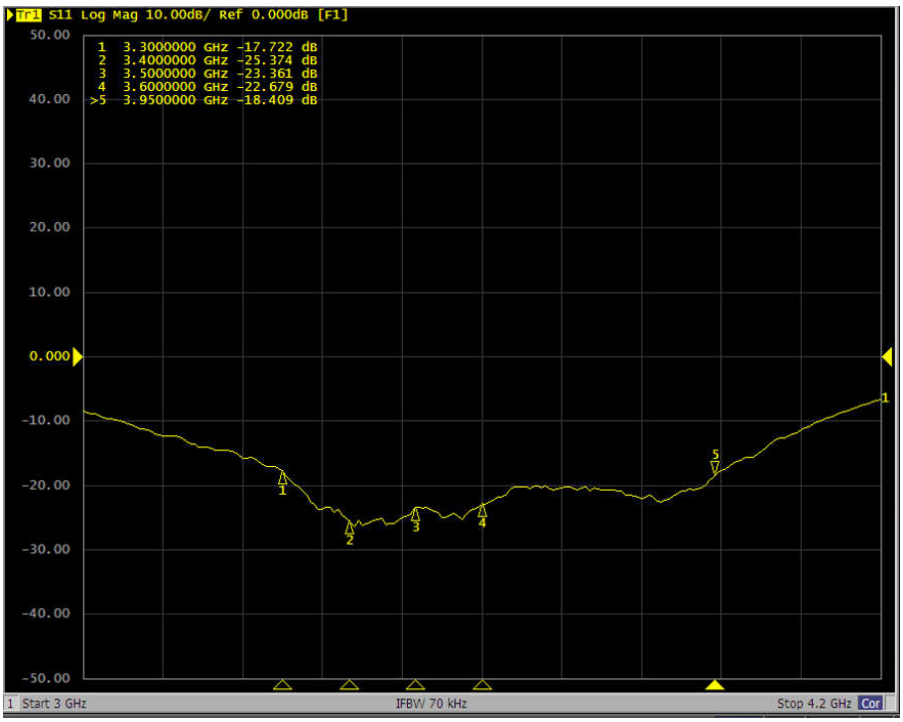
<Justification of the extended calibration>

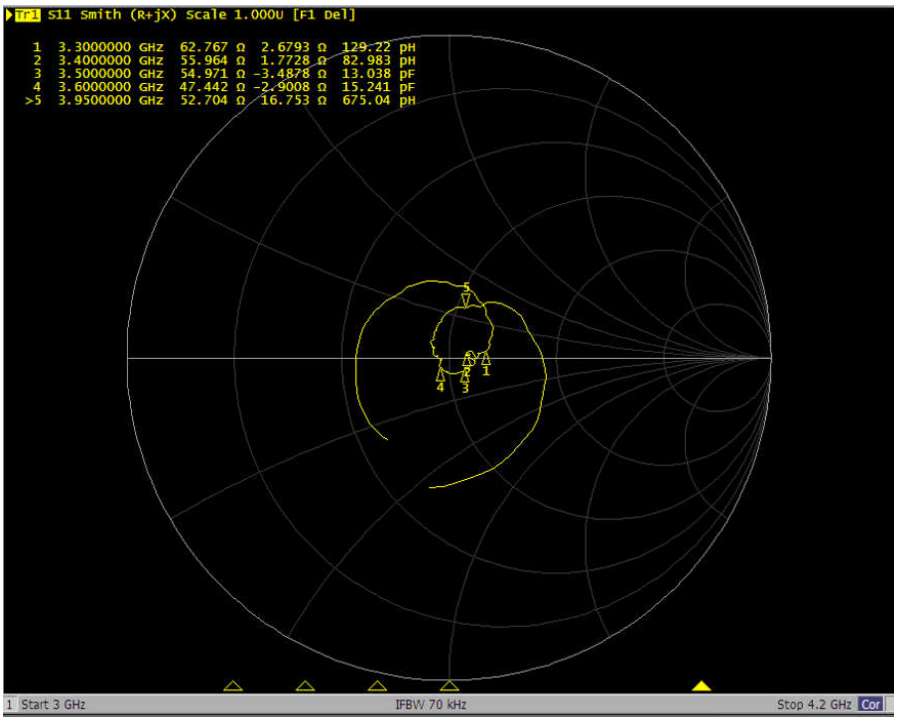
CD3500V3 – serial no. 1022						
	3500MHZ					
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
06.08.2023 (Cal. Report)	-23		56.9		-3.2	
06.07.2024 (extended)	-23.361	1.57	54.971	-1.929	-3.4878	-0.2878

The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

<Dipole Verification Data> - CD3500V3, serial no. 1022(Data of Measurement : 06.07.2024)

3500MHz - Head





Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client **Sporton**
Taoyuan City

Certificate No: DAE4-1311_Sep24

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BM - SN: 1311
Calibration procedure(s)	QA CAL-06.v30 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	September 16, 2024

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	27-Aug-24 (No:40547)	Aug-25
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Auto DAE Calibration Unit	SE UWS 053 AA 1001	23-Jan-24 (in house check)	In house check: Jan-25
Calibrator Box V2.1	SE UMS 006 AA 1002	23-Jan-24 (in house check)	In house check: Jan-25

	Name	Function	Signature
Calibrated by:	Adrian Gehring	Laboratory Technician	
Approved by:	Sven Kühn	Technical Manager	

Issued: September 18, 2024

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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Swiss Calibration Service

Accreditation No.: **SCS 0108**

Glossary

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
  - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
  - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
  - *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.
  - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
  - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range:	1LSB =	6.1μV ,	full range =	-100...+300 mV
Low Range:	1LSB =	61nV ,	full range =	-1.....,+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	405.506 ± 0.02% (k=2)	405.055 ± 0.02% (k=2)	404.815 ± 0.02% (k=2)
Low Range	3.96342 ± 1.50% (k=2)	3.99360 ± 1.50% (k=2)	3.97334 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	224.0 ° ± 1 °

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	200033.11	-5.77	-0.00
Channel X	+ Input	20008.61	1.65	0.01
Channel X	- Input	-20001.96	4.45	-0.02
Channel Y	+ Input	200035.79	-3.20	-0.00
Channel Y	+ Input	20003.47	-3.37	-0.02
Channel Y	- Input	-20007.44	-0.98	0.00
Channel Z	+ Input	200037.00	-2.34	-0.00
Channel Z	+ Input	20008.08	1.30	0.01
Channel Z	- Input	-20005.49	1.07	-0.01

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2001.02	-0.80	-0.04
Channel X	+ Input	201.60	-0.01	-0.01
Channel X	- Input	-197.54	0.68	-0.34
Channel Y	+ Input	2001.52	-0.13	-0.01
Channel Y	+ Input	201.06	-0.44	-0.22
Channel Y	- Input	-199.42	-1.12	0.57
Channel Z	+ Input	2002.31	0.68	0.03
Channel Z	+ Input	200.70	-0.64	-0.32
Channel Z	- Input	-198.99	-0.52	0.26

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	13.59	11.97
	- 200	-11.93	-13.66
Channel Y	200	-13.40	-13.52
	- 200	11.41	11.90
Channel Z	200	-18.03	-18.01
	- 200	16.85	16.65

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	3.87	-2.35
Channel Y	200	9.00	-	5.53
Channel Z	200	9.73	5.83	-

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	15436	15737
Channel Y	16321	15861
Channel Z	16570	16739

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	0.63	-1.38	2.64	0.69
Channel Y	0.04	-0.85	1.15	0.46
Channel Z	0.13	-2.09	1.32	0.56

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9